

# BI-WEEKLY COMMENTS ON SI

## Comment 2

### BASE UNITS AND DERIVED UNITS

#### 2.1 SI base units

As measurement systems evolved over the years, various units were created to express the magnitude of physical quantities. Although there are hundreds of physical quantities, it is amazing that they can all be expressed in terms of a few base units. The scientists who developed the International System of Units (abbreviation SI), decided to adopt seven base units. These base units are listed below, along with their symbols:

<u>base unit</u>	<u>symbol</u>	<u>description</u>
meter	m	SI base unit of length
kilogram	kg	SI base unit of mass
second	s	SI base unit of time
kelvin	K	SI base unit of temperature
ampere	A	SI base unit of electric current
candela	cd	SI base unit of luminous intensity
mole	mol	SI base unit of amount of substance

You can get more information about these base units by referring to the BIPM web site listed at the bottom of the page ⊗ Getting to know SI .

#### 2.2 SI derived units

As we have said, it is a remarkable fact that all physical quantities such as areas, volumes, forces, speeds, magnetic fluxes, and so forth, can be expressed in terms of one or more SI base units. These expressions in terms of base units are called derived units. For example, the derived unit for speed is the meter per second, and its symbol is m/s. Similarly, the derived unit for volume is the cubic meter, and its symbol is  $m^3$ .

#### 2.3 Derived units with special names

In creating the various SI derived units, a serious problem arose. The reason is that some

derived units became very cumbersome to handle, even in symbolic form. For example, it can be shown that the derived unit of FORCE is the kilogram meter per second squared, and its symbol is  $\text{kg}\cdot\text{m}/\text{s}^2$ . Such cumbersome units were given special names and corresponding symbols. In the case of FORCE, the SI special name for kilogram meter per second squared is “newton”, and the corresponding SI symbol is “N”.

The General Conference of Weights and Measures (Conférence Général des Poids et Mesures, or CGPM) has established 22 such special names. Among these special names appear the well-known volt, watt, joule and pascal.

The Wildi SI Charts show the SI special names for all these “cumbersome” derived units, along with their expression in terms of SI base units. For example, referring to the SI chart on ⊗ FORCE, the SI derived unit is indeed the “newton” with its symbol “N” displayed on the right-hand side of the box. On the left-hand side of the box, with the multiplier 1, is displayed  $[\text{kg}\cdot\text{m}/\text{s}^2]$  which is the “newton” expressed in SI base units.

#### 2.4 Just for fun – try this SI quiz

Using the Wildi SI Charts, find the special names and symbols of the derived units for the quantities listed in the following table:

	A	B	C	D
1	energy	magnetic flux	power	pressure
2	absorbed dose	electric resistance	magnetic flux density	frequency
3	inductance	torque	capacitance	viscosity

*The A1 to D3 solutions are given below. For example, the solution to B3 is newton meter. But don't look until you've tried to discover the appropriate special names by yourself.*

#### ⊗ SOLUTIONS

THAT'S ALL FOR NOW, FOLKS !

SEE YOU IN TWO WEEKS !